## REMARKS

### Statement of the Substance of the Interview (MPEP713.04)

As noted in 37 CFR 1.133, the Applicant may be required to make the Substance of the Interview of record in the application file. The Interview Summary (PTOL-413):prepared by the Examiner was substantially correct but some additional points are noted.

1) A telephonic interview was conducted on February 23, 2009 between Attorney Andrew P. Cernota, Inventor, Prof. Mart Min, European Agent Mart Koppel, and Examiners Renee Danega and Jeff Hoekstra. Applicant thanks the Examiners for courtesy of the interview.
2) The substance of Examiner Danega's Interview Summary (Mail Date February 26, 2009) is correct, the applicant wishes to make certain points of record regarding the interview.
3) Prof. Min highlighted differences between the cited references and his invention of claim 18 and also with claim 10. These distinctions are addressed at greater length in the remarks.
4) In response to these comments of Prof. Min, the Examiners offered suggestions regarding claims 10 and 18, in particular to cure the rejection under 35 USC 112, and emphasize the signal analysis component of claim 10 and incorporate into claim 18 elements regarding the linkage between the measured signal and the suppression of recited higher harmonics.

### Claims Rejections - 35 USC §112 First Paragraph

The Office has rejected claims 10 and 13 under 35 U.S.C. 112, first paragraph, which recites:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly

connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. [emphasis added]. MPEP§2161

More particularly, the Office explains that "The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. It is unclear in claim 10 how "said first modified signal" can have "different constant value sections from said first modified signal". Likewise, in claim 13 it is unclear how "said second modified signal" can have "a different value from the constant value sections of said second modified signal". It is unclear how one would make a modified signal different from itself."

The applicant has amended claims 10 and 13 once again to clarify the language defining the first modified signal (claim 10) and the second modified signal (claim 13), specifically that such first modified signal has an upper constant value section, a lower constant value section, and that both said upper constant value section and said lower constant value sections are symmetrically shortened by a predetermined first time interval by introducing and a third constant value section that is different from said upper constant value and said lower constant value. See also paragraph [0019] and Fig. 2A of the specification.

Claims 10 and 13 are further amended to state that the purpose of modifying the signals is to suppress a set of higher odd harmonics in such signal.

The applicant respectfully submits that the amendments to the claims cure the cite Office's rejection and respectfully request that the rejection of these claims under 35 USC 112 be withdrawn.

**Claim Rejections – 35 USC § 102**

The Office has rejected claims 18 and 19 as anticipated by US Pat. No 6377845 to Kinast. A rejection based on anticipation requires that a single reference teach every element of the claim (MPEP § 2131). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir.

1989). Or stated in another way, a "claim is anticipated only if each and every element as set forth in the claim is found, . . . described in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

In the light of the interview with the Examiner on 23 Feb 2009, the applicant has amended claim 18 to emphasize that the device is adapted to measure complex impedance of an object. The amended claim now reads:

Claim 18 (Currently Amended): A device for measuring of an electrical complex impedance of an object, comprising:

first generator for generating an excitation signal, wherein the excitation signal is modified rectangular wave signal, wherein the excitation signal has constant value sections, that are shortened by a first time interval during each half period of the excitation signal to suppress a first set of odd higher harmonics of the excitation signal;

second generator for generating a reference signal, wherein the reference signal is modified rectangular wave signal, wherein the reference signal has constant value sections, that are shortened by a second time interval during each half period of the reference signal to suppress a second set of odd higher harmonics of the reference signal; and

a synchronous detector, having a first input, and a reference input, wherein the excitation signal is applied to an input of the object, a response signal is received from an output of the object through the first input of the synchronous detector, and the reference signal is applied to the reference input, wherein an output signal of the synchronous detector is proportional to the electrical complex impedance of the object and is free of said first set and said second set of higher harmonics.

Applicant has carefully considered the Office rejections and respectfully disagrees that the invention is anticipated by US Pat. No 6,377,845 issued to Kinast. The examiner argues that "Regarding claim 18, Kinast teaches a device for measuring of an electrical complex impedance". In fact, the cited '845 reference does not measure complex impedance, but "only the resistive component of the combined total impedance". (see column 2, lines 5 to 10). The object of the invention of the cited '845 reference is "an impedance respiration monitoring circuit, the sensitivity of which does not vary appreciably over a wide range of cable shunt capacitance and series resistance, and patient baseline resistance" (see column 1, lines 63-67). The output of the cited '845 reference device is "proportional to the resistive component of the impedance of the network without the influence from the capacitive components" (see column 10, lines 66 and 67, column 11, lines 1-2).

The Office further argues that the cited '845 reference invention has "a first generator (33) for generating an excitation signal capable of generating a modified rectangular wave signal, the signal having constant value sections shortened by a first time interval during each half period to suppress higher harmonics". While the generator (33) in the cited '845 reference is capable of generating a square wave or a rectangular wave, including with duty cycle different than 50% (see column 13 lines 34 to 37) and such wave have constant value sections (or +V and –V, see column 11, lines 38-39), nothing in the cited '845 reference suggest that the generator is capable of generating a signal were the constant value sections are shortened. In fact, the cited '845 reference explains that "the square wave generator output has only two states, which may be designated as +V and –V" (see column 11, lines 38-39).

Furthermore, even though the cited '845 reference may disclose that the square (or rectangular wave) signal comprises only odd harmonics (column 13, 60-62), nothing in the cited '845 reference teaches or suggests to modify the square or rectangular wave by shortening the constant value sections to suppress higher odd harmonics.

The Office further argues that the cited '845 reference teaches "a second generator for generating a reference signal, wherein the reference [signal] is a modified rectangular wave signal having constant value sections shortened by a second time interval during each half period to suppress higher harmonics." However, in fact the cited '845 reference only has one square wave or rectangular wave generator (33), the signal of which is introduced into the object and into the demodulator (34) (see Fig. 7). The cited '845 reference uses a well known method of using synchronous detector for noise rejection, explaining that "it is well known that such a demodulator only exhibits sensitivity to signals in narrow bands at the fundamental and odd harmonics of the measured frequencies" (see column 11, lines 56-60). Nothing in the cited '845 reference suggests modifying this method by using two generators for generating two different signals for synchronous detection

Thus, the applicant respectfully submits that at least for those reasons recited above, not all elements of claim 18 are recited in the cited '845 reference. The applicant, therefore, respectfully request that the Office withdraw its rejection of claim 18, and claim 19 that is dependant therefrom.

**Claim Rejections – 35 USC § 103**

The Office has quoted the statute from 35 USC 103(a), which is referenced herein. The Office has rejected claims 10 and 17, as being unpatentable over Min et al ("Design Concepts of Instruments of Vector Parameter Identification") in view of Kinast U.S. Pat. No. 6377845. Applicant has carefully considered the Office rejections and respectfully disagrees.

According to the MPEP §2143.01, "[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found in either the references themselves or in the knowledge generally available to one of ordinary skill in the art." Thus, despite the recent ruling in *KSR Int'l Co. v. Teleflex, Inc.,* No. 04-1350 (U.S. Apr. 30, 2007), obviousness cannot be established by combining prior art to produce the claimed invention absent some reasoning

supporting the combination. The mere fact that the prior art may be modified in the manner suggested by an examiner does not make the modification instantly obvious.

"...[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *See Lee*, 277 F.3d at 1343-46; *Rouffett*, 149 F.3d at 1355-59." *In re Kahn* (Fed. Cir. 2006, 04–1616).

Therefore, in formulating a rejection under 35 U.S.C. 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed. (*see* USPTO Memo May 30, 2007 from Margaret A. Focarino, Deputy Commissioner for Patent Operations)

A useful presentation for the proper standard for determining obviousness under 35 USC §103(a) can be illustrated as follows:

1. Determining the scope and contents of the prior art;
2. Ascertaining the differences between the prior art and the claims at issue;
3. Resolving the level of ordinary skill in the pertinent art; and
4. Considering objective evidence present in the application indicating obviousness or unobviousness.

Specifically, the Office argues that while "Min does not expressly teach the excitation signal to be generated from rectangular waves. . . Kinast teaches a method for measuring impedance through an object in which sinusoid or non-sinusoid waves such as rectangular or triangular waves can be used in a method with synchronous demodulation." As noted in the telephone interview, the cited Min reference is a publication of the inventor, with which he is intimately acquainted. The applicant respectfully submits that there is no motivation or suggestion to combine the cited '845 reference with the Min reference. As already explained, the cited '845 reference does not teach the method of measuring impedance, but resistance. Nowhere does the cited '845 reference disclose using modified rectangular signals for measuring complex

impedance. The cited '845 reference's method cannot be used for solving the problem in Min, namely to reduce the harmonic content of the output signal of the synchronous detector.

Furthermore, as already explained above, while the cited '845 reference uses square or rectangular wave, the cited '845 reference does not teach or suggest generating a first modified signal so that the constant value sections are shortened by a predetermined first time interval during which the signal has different constant value. In fact, the cited '845 reference adds nothing to what is already in Min's article.

The applicant has explained the differences between Min's article and the claimed invention during the interview on 23 Feb 2009. Particularly, Min does not disclose any use of rectangular waves for measuring complex impedance, but instead uses stepwise approximation of sinus signals. The goal of Min is to use as few discrete levels for the excitation signal and for the reference signal as possible, however, there must be at least 3 to 4 discrete levels per half period (6-8 per period, see Fig. 4 page 2) of the signal compared to 3 levels according to the invention. Nothing in Min discloses or suggests that instead of an approximated sinus signal, where several (7-8) discrete levels approximate the sinus signal during each period of the signal, a simple rectangular signal with only three discrete levels may give a comparable result, provided that the lengths of each discrete level of the rectangular signal are selected accordingly.

Due to the Office's rejection of claims 10 under 35 USC 112 First Paragraph and as a result of the Interview with the Examiner, the applicant has further clarified the language of claim 10. The applicant believes that the differences between Min and the claimed invention have become more apparent.

The Office argues regarding claim 17 that "Min teaches the first modified signal has a value of zero during said predetermined first time interval (pg 2)". In fact it can be seen from Min's article that the proposed signal has never zero constant (or discrete) levels (see, e.g., Fig. 4, $G_{I,4}$, $G_{I,3}$), but the signal jumps from the smallest positive discrete level to the first negative value closest to zero.

**The Office rejected claims 11 to 16** under 35 USC 103(a) as being unpatentable over Min as applied to claim 10 above, and further in view of Eek *et al.* (Electrical Bio-Impedance Measurement in a Rate-Adaptive Pacemaker), also a publication for which Prof. Min is an author. The Office argues that "Min doesn't expressly teach shortening signals over a first time interval to suppress the 3rd harmonic, but does teach shortening them to eliminate harmonics (Figure 4)(pg 2).

Claims 11 to 16 are dependant from claim 10. As already explained, Min and in particular Fig. 4 does not teach shortening the constant value sections of a rectangular wave for a first time interval during which the signal has different constant value for the purpose of suppressing higher harmonics.

Eek does not teach the use of square wave signals for impedance measurements, but instead it discloses the use of a stepwise approximation of the sine wave to get rid of a problem connected with the impact of higher odd harmonics to the measurement results of the synchoronous demodulator. The goal is to obtain a stepwise approximation as close as possible to the sine wave using the simpliest hardware. That is, the number of approximation levels must be minimal, but, according to Eek, still at least four (4) discrete levels per half period are needed to provide satisfactory results. The step levels are taken are equal to the values of the sine function at the center point of the time interval of each step. The harmonic content of the stepwise approximated waveform depends only on the number of time intervals n in one cycle. In the Eek reference, n=16, and the first pair of higher odd harmonics is n +/- 1), that is $15^{th}$ and 17th.

Eek is based on approximating the sine wave using the values of the sine wave while, as already explained in regard with claim 10, the applicant's modified rectangular signals have only three levels (upper constant value, lower constant value, and the third constant value, that is in between and that can be also zero) and these values of these levels are independent from the values of sine function. Instead, the importance is in the length of each section (having upper, lower and intermediate level) during each period of the signal.

Even though Eek also tries to suppress higher harmonics, nothing in Eek teaches or suggests suppressing a set of higher odd harmonics by modifying a rectangular wave (claims 11 and 12), specifically by shortening the upper and lower constant value sections. Furthermore, nothing in Eek suggests modifying both the excitation signal and the reference signal to remove different sets of higher odd harmonics from different signals (claims 15 and 16).

Both Min and Eek disclose stepwise synthesis of sine waves with minimal number of discrete levels. While the goal of both Min and Eek is to improve the accuracy of the method by cleverly choosing the right number of discrete levels, nothing in Min nor Eek suggest that instead of mimicking sine waves, modified rectangular waves can be used with surprisingly good results.

Regarding claims 12, 15 and 16, the Office further alleges that "such intervals could be found through application of known Fourier transform by one ordinary skilled in the art". The applicant respectfully disagrees. Fourier transform is an analytical tool which enable to find the harmonic content of signals but not to synthesize the signals. In other words, Fourier transform can be used to determine a harmonic content of a known signal, but it does not allow to do the opposite – to find a signal based on desired harmonic content of a signal.

Regarding claim 14, the examiner argues that "Min teaches taking the first signal to zero, but not expressly the second (Figure 4)." As already explained, in fact in Min the signal has never zero (constant) value. Therefore, there is also no suggestion in Min to take the second signal to zero to eliminate harmonics.

The applicant respectfully submits that at least for the foregoing reasons, the cited references, alone or in combination fail to disclose the claimed invention of claims 10-17. The applicant therefore respectfully requests that the Office withdraw its rejection of these claims.

Applicant believes the above amendments and remarks to be fully responsive to the Office Action, thereby placing this application in condition for allowance. No new matter is added. Applicant requests speedy reconsideration, and further requests that Examiner contact its attorney by telephone, facsimile, or email for quickest resolution, if there are any remaining issues.

Respectfully submitted,

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